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CHITTENDEN COUNTY
AIR POLLUTANT EMISSION INVENTORY

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Environmental Health Service

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16. Abstracts

The report is a compilation of air pollutant emissions in the Chittenden County Area. The objective of this emission inventory is to determine the quantity of various air pollutants emitted, as well as delineate their geographical variations. This was done using a modified form of "Compilation of Air Pollutant Emission Factors". The study area was divided into a grid coordinate system and the emission quantities were reported in terms of tons per year. The pollutants considered in this survey were: aldehydes, oxides of nitrogen, carbon monoxide, hydrocarbons, organic acids, oxides of sulfur, and particulate matter. Data gathered herein are primarily representative of 1968. The Study Area consists of the Greater Burlington Area and the surrounding towns of Bolton, Charlotte, Colchester, Hinesburg, Huntington, Jericho, Milton, Richmond, Shelburne, St. George, Underhill, Westford, and Williston.

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Combustion
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Industrial wastes
Evaporation
Aircraft
Ships

17b. Identifiers/Open-Ended Terms

Chittenden County, Vermont
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Prepared by

Glenn Aiken
Thomas W. Fitzpatrick

VERMONT STATE DEPARTMENT OF HEALTH
DIVISION OF INDUSTRIAL HYGIENE

October, 1969

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Introduction

This report is a compilation of air pollutant emissions in the Chittenden County Area. The objective of this emission inventory is to determine the quantity of various air pollutants emitted, as well as delineate their geographical variations. This was done using a modified form of "Compilation of Air Pollutant Emission Factors"[1]. The study area was divided into a grid coordinate system and the emission quantities were reported in terms of tons per year.

The pollutants considered in this survey were: aldehydes, oxides of nitrogen, carbon monoxide, hydrocarbons, organic acids, oxides of sulfur, and particulate matter. Data gathered herein are primarily representative of 1968. "Residential" refers to homes and small commercial establishments using about the same amounts of fuel.

Study Area

The Study Area, presented in Figure 1, consists of the Greater Burlington Area (Burlington, South Burlington, Essex and Winooski) and the surrounding towns of Bolton, Charlotte, Colchester, Hinesburg, Huntington, Jericho, Milton, Richmond, Shelburne, St. George, Underhill, Westford, and Williston. The Area occupies 533 square miles and contains an estimated 1968 population of 92,120 (see Table 1). The City of Burlington contains 43% of the Study Area's population while the Greater Burlington Area contains 72%. Industrial establishments are concentrated almost entirely in Greater Burlington and are, with but few exceptions, rather small. The Greater Burlington Area is a shopping, educational, and medical center. Hence pollutants, to a considerable degree fall in the institutional or commercial categories as far as stationary sources are concerned.

As can be seen by Table I and Figure 2, the areas outside Greater Burlington are sparsely populated and are largely farmland with an Interstate Highway system running through them. For this reason and because there is considerable commuting to and from Burlington (as well as a large amount

Figure 1. Chittenden County study area.

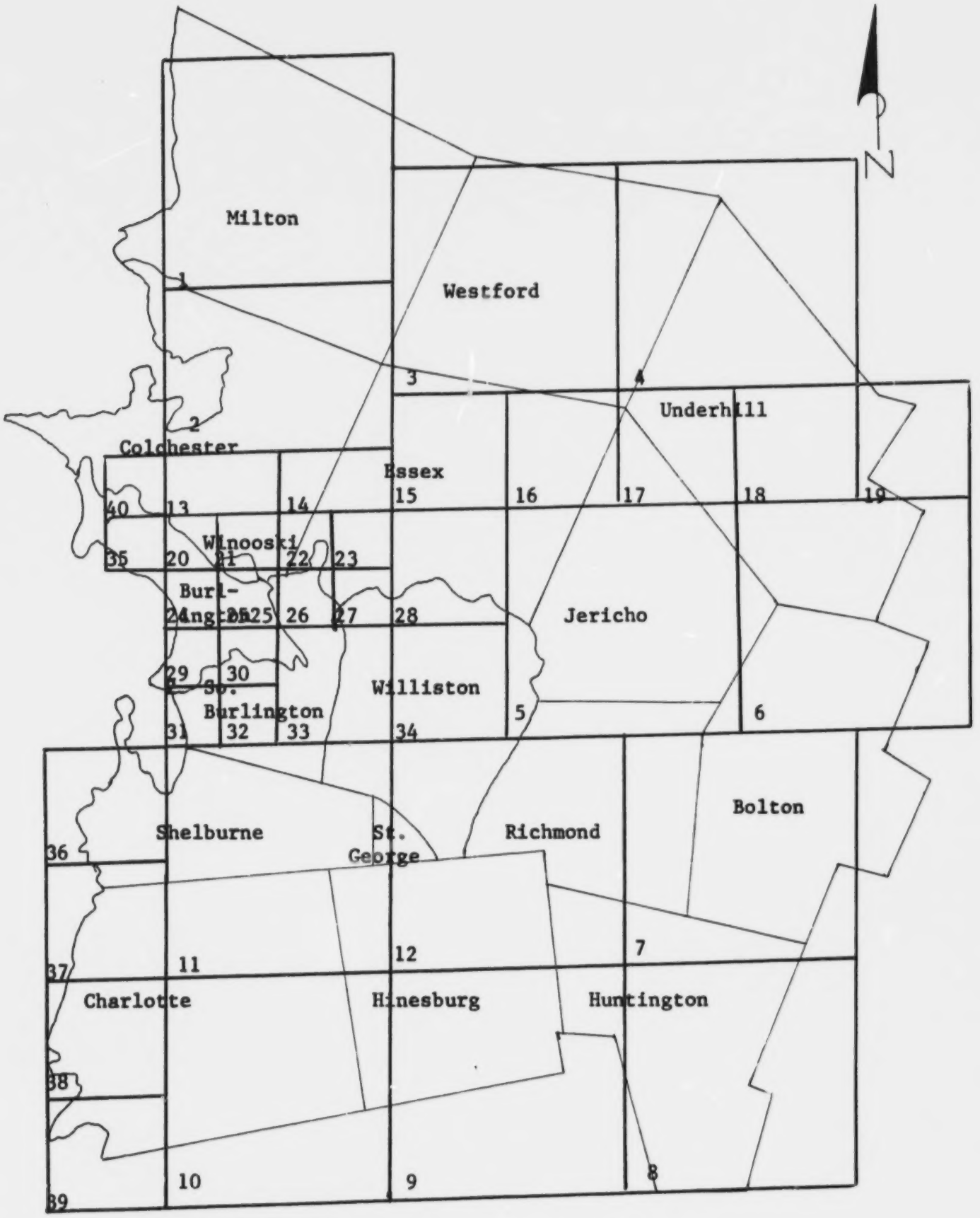


Figure 2. Chittenden County study area and grid system.

TABLE I. POPULATION AND AREA CHARACTERISTICS FOR THE CHITTENDEN COUNTY STUDY AREA. *

TOWN	POPULATION	% OF TOTAL	AREA (SQ.MI.)	POPULATION DENSITY
Bolton	290	0.031	41.1	7.1
Burlington	39,632	43.01	36.0	1100.0
Charlotte	1,530	1.66	37.59	41.0
Colchester	5,620	6.10	23.43	240.0
Essex	9,513	10.32	34.86	273.0
Hinesburg	1,605	1.74	33.17	48.0
Huntington	630	0.69	34.64	18.0
Jericho	1,580	1.71	33.47	47.0
Milton	3,705	4.02	43.47	85.0
Richmond	1,830	1.98	28.31	65.0
Shelburne	3,285	3.56	23.29	141.0
So.Burlington	9,120	9.90	14.08	648.0
St.George	295	0.032	3.41	87.0
Underhill	1,090	1.18	48.89	22.0
Westford	815	0.88	36.23	23.0
Williston	2,915	3.16	28.84	101.0
Winooski	8,665	9.40	1.24	6988.0
Area totals	92,120	99.373	502.02	584.3 (Avg.)

*Estimates from the Vermont Central Planning Commission

of tourist and ski area traffic) motor vehicle emissions constitute a sizable portion of the emissions total.

Topography

The Chittenden County Area is located near the Northwestern corner of Vermont. Route 7, Route 15, Route 2, and Interstate 89 converge in Burlington. These main arteries follow deep valleys where the rural population is centered.

Climatology

Precipitation is rather evenly distributed throughout the year and temperatures are usually cool. Temperatures of zero or below will occur from November through March whereas temperatures of 75-90 occur from July-August. The prevailing winds are from the North to the South with an average speed of 9 miles per hour.

Grid Coordinate System

For the purpose of this survey, the study area was divided into 40 grids based on a Universal Transverse Mercator Projection (UTM). Three grid sizes of 10,000, 5,000, 2,500 meters on a side were used for delineating emissions of: sulfur oxides, aldehydes, carbon monoxide, organic acids, particulates, and nitrogen oxides (Figure 3).

Summary of Results

The following is a brief summary of pollutant emissions and sources in the Chittenden County Study Area.

1. Aldehydes (130 tons/year) are emitted primarily from transportation. The only other large producers of aldehydes were stationary fuel combustion sources. They emitted about 40 percent of the total.

2. Oxides of nitrogen (6564 tons/year) were discharged primarily from transportation (30 percent) and stationary fuel combustion sources (50 percent).

3. The major sources of carbon monoxide (38,450 tons/year) were the

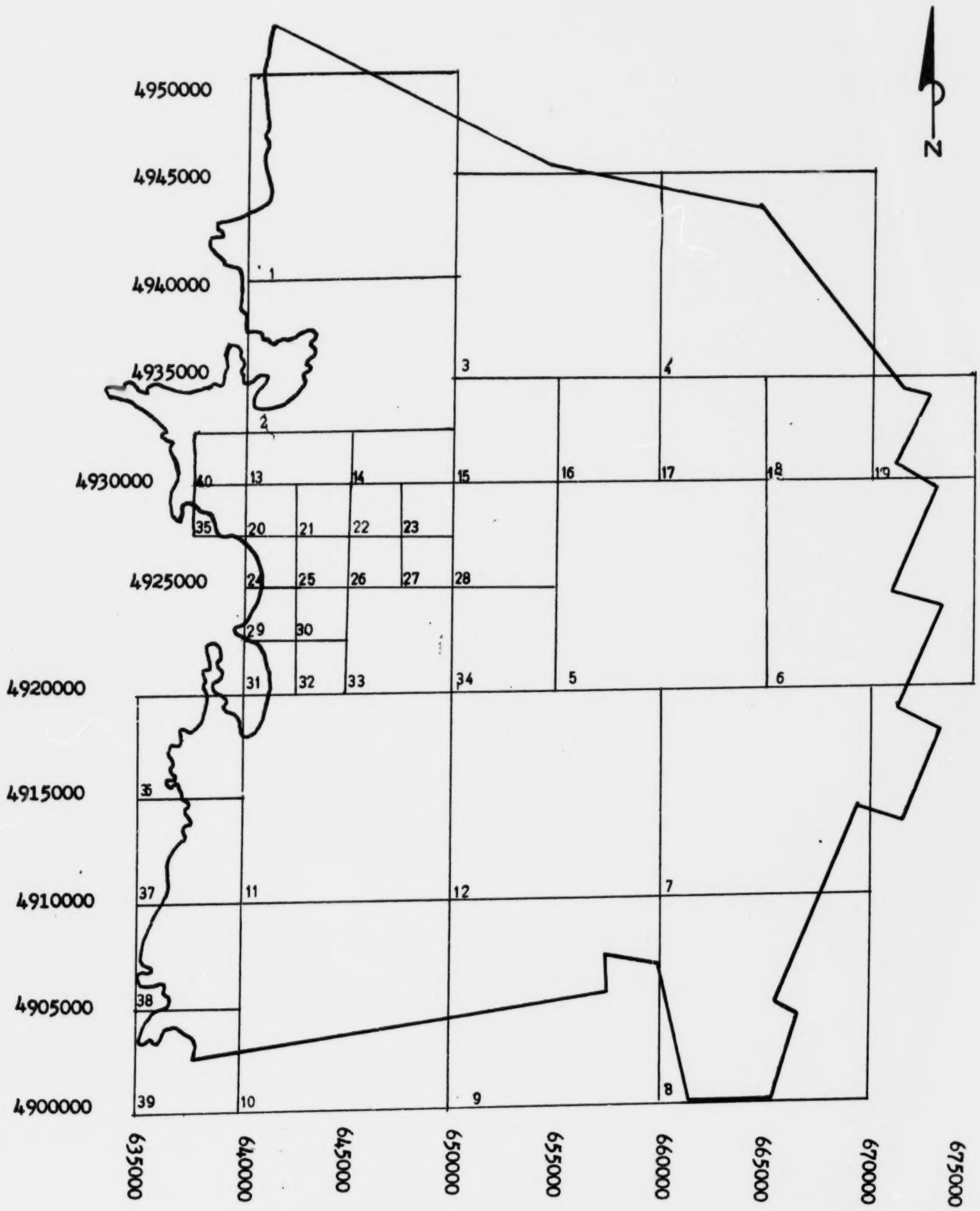


Figure 3. Chittenden County study area grid system.

operation of gasoline and diesel powered motor vehicles which emitted 90 percent of the total. Fuel combustion accounted for slightly less than 8 percent of the total emissions.

4. Gasoline combustion and evaporation account for approximately 92 percent of the hydrocarbons emitted annually and fuel combustion in point sources accounted for about 6 percent.

5. Solid waste disposal accounts for about 80 percent of the organic acids produced in a year while fuel combustion sources emit the remaining 20 percent.

6. Sulfur oxides (3548 tons/year) are emitted primarily from fuel combustion in stationary sources. Stationary sources account for about 88 percent, while residential combustion and transportation contribute the remaining 12 percent.

7. Coal and gasoline combustion account for more than 70 percent of the total particulate emissions of 885 tons/year. Residential fuel consumption contributed about 12 percent and refuse burning 18 percent of the total particulate emissions.

The emissions of pollutants discharged to the air in the Study Area are summarized in Table 2. The validity of these results is dependent on the accuracy and applicability of the emission factors used. These factors, for the most part, represent average emission rates for a particular industry or fuel type. Because of the inherent differences in types of equipment, operating rates, control equipment, and efficiency of operation among the plants and fuel users within a given category, the application of the emission factors to any individual plant or even a smaller number of similar plants or processes may result in a discrepancy between the actual and the estimated emissions. However, the estimates of total pollutants from all sources in the Study Area should be fairly accurate.

TABLE 2. SUMMARY OF AIR POLLUTANTS IN THE CHITTENDEN COUNTY STUDY AREA,1968 (TONS/YEAR)

SOURCE	ALDEHYDES	NO_x	CO	HC	ORGANIC ACIDS	SO_x	PARTICULATE
Transportation							
Vehicles	72	1968	35,048	3108	Neg.	189	254
Stationary fuel combustion:							
Industry	10	1704	1039	202	15	1107	145
Steam electric	2	344	208	40	3	240	27
Residential	33	236	33	49	Neg.	462	139
Commercial							
Institutional	13	2214	1351	263	19	1560	176
Solid waste							
Open dump	Neg.	62	482	28	85	Neg.	91
Backyard	Neg.	36	290	17	50	Neg.	53
Industrial process	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Solvent evaporation							
Dry cleaning	Neg.	Neg.	Neg.	180	Neg.	Neg.	Neg.
Gasoline	Neg.	Neg.	Neg.	3531	Neg.	Neg.	Neg.
Total	130	6564	38,451	7418	172	3558	885

Neg.= Negligible

Emissions by category

For the purpose of compiling the basic data and emission estimates, the air pollutant sources were classified into the following five categories:

1. Fuel combustion in stationary sources.
2. Transportation.
3. Solid waste disposal.
4. Solvent evaporation.
5. Industrial processes.

Fuel combustion in stationary sources

All three major fuels are consumed within the Study Area with fuel oil being the most significant. In 1968 fuel oil accounted for 66.50x 10^{11} BTU's or 86.9 percent of the total energy output, with natural gas accounting for 2.5 percent and coal 10.2 percent. Electricity accounted for about 0.4 percent.

The Burlington City Light plant consumed 97 percent of the total coal utilized by all sources. The particulate control equipment in this plant is 96.4 percent efficient. Fuel oil was consumed primarily in residences (85.4 percent) and for commercial-industrial heating (16.6 percent). About 90 percent of the fuel oil was distillate, having a sulfur content of 0.20-2.5 percent. (Tables 3 and 4)

Over 60 percent of the natural gas consumed in the Study Area was used for residential purposes while 40 percent was used by industrial-commercial facilities.

Fuel apportionment and data sources for stationary sources

Residential home heating fuel was determined by questionnaires sent to the dealers. The fuel was apportioned by township and population, then totalled by grid.

Natural gas (Table 6) usage was obtained from the gas company in the area and is the most accurate of the fuel data. This was provided on a county

TABLE 3. SUMMARY OF FUEL CONSUMPTION BY STATIONARY SOURCES FOR THE STUDY AREA, 1968.

SOURCE	COAL 1000 TONS	FUEL OIL RESIDUAL 10^3GALS.	FUEL OIL DISTILLATE 10^3GALS.	NATURAL GAS 10^6CU.FT.
Steam-electric	31	494	1,151	
Industrial-commercial		7,188	3,230	60
Residential	1	0	32,384	132
Total	32	7,682	36,765	192

TABLE 4. SULFUR AND ASH CONTENT OF FUELS CONSUMED IN THE STUDY AREA, 1968.

FUEL	% SULFUR	% ASH
Coal	2.5	7.9
Residual oil	2.5-3.0	
Distillate oil	0.2-2.5	

basis with a breakdown by residential, industrial-commercial, and institutional source categories.

Residual fuel oil for the Study Area was obtained through questionnaires sent to the individual users. All residual oil was used by point sources and located by grid coordinates.

Distillate fuel oil totals were obtained by questionnaires sent to point sources and fuel dealers. Aside from the Greater Burlington Area, the Study Area is essentially rural in character, consisting of townships 6 miles square. In each of these there are one or two towns where most of the population is concentrated. In apportioning domestic fuel consumption an arbitrary figure of 75 percent of the fuel was allocated to the villages and 25 percent was distributed evenly over the remainder of the township. (See Table 5 and 7)

In the Greater Burlington Area, the grid system recommended resulted in some residential units in all grids with point sources contributing to some of these grids also.

Coal consumption in the steam-electric power plant was determined by personal contact. Residential coal consumption was found by contacting the dealers.(See Table 3)

Emissions from fuel combustion in stationary sources

Air pollutant emissions resulting from fuel combustion in stationary sources are listed by source in Table 8.

Transportation

Three types of transportation sources of air pollution are considered in this survey: motor vehicles, aircraft and ships. Motor vehicles, which are by far the most important source of air pollution in this category are further subdivided according to type of fuel--gasoline or diesel.

In computing pollutants from motor vehicles, alternative methods are

TABLE 5. SUMMARY OF DOMESTIC COAL EMISSIONS IN THE STUDY AREA, 1968. (TONS/YEAR)

GRID	TOWNSHIP	ALDEHYDES	NO_x	CO	HC	SO_x	PARTICULATES
27	Burlington	Neg.	0.4	2.5	0.5	1.3	0.6
38	Charlotte	Neg.	0.4	2.5	0.5	1.3	0.6
2	Colchester	Neg.	0.4	2.5	0.5	1.3	0.6
28	Essex	Neg.	0.4	2.5	0.5	1.3	0.6
9	Hinesburg	Neg.	0.4	2.5	0.5	1.3	0.6
5	Jericho	Neg.	0.4	2.5	0.5	1.3	0.6
1	Milton	Neg.	0.4	2.5	0.5	1.3	0.6
12	Richmond	Neg.	0.4	2.5	0.5	1.3	0.6
11	Shelburne	Neg.	0.4	2.5	0.5	1.3	0.6
3	Westford	Neg.	0.4	2.5	0.5	1.3	0.6
34	Williston	Neg.	0.4	2.5	0.5	1.3	0.6
24	Winooski	Neg.	0.4	2.5	0.5	1.3	0.6
	Total	Neg.	4.8	30.0	6.0	15.6	7.2

Neg.= Negligible

TABLE 6. SUMMARY OF EMISSIONS FOR NATURAL GAS FOR THE STUDY AREA, 1968. (TONS/YEAR)

ALDEHYDES	NO_x	CO	HC	ORGANIC ACIDS	SO_x	PARTICULATE
Neg.	39	Neg.	Neg.	Neg.	Neg.	6

Neg.= Negligible

TABLE 7. SUMMARY OF DOMESTIC FUEL OIL EMISSIONS BY GRID IN THE STUDY AREA, 1968. (TONS/YEAR)

GRID NO.	ALDEHYDES	NO_x	CO	HC	ORGANIC ACIDS	SO_x	PARTICULATES
1	1.16	7.00	1.16	1.74	Neg.	22.09	4.63
2	0.05	0.28	0.05	0.07	Neg.	0.84	0.19
3	0.35	2.12	0.35	0.53	Neg.	6.76	1.40
4	0.60	0.36	0.60	0.89	Neg.	1.14	0.24
5	0.59	3.50	0.59	0.88	Neg.	11.26	2.36
6	0.07	0.43	0.07	0.11	Neg.	1.37	0.28
7	0.64	3.83	0.64	0.96	Neg.	12.18	2.55
8	0.22	1.30	0.22	0.33	Neg.	4.16	0.87
9	0.49	2.95	0.49	0.74	Neg.	9.40	1.97
10	0.09	0.55	0.09	0.14	Neg.	1.74	0.36
11	0.07	0.44	0.07	0.11	Neg.	1.14	0.29
12	0.29	1.70	0.29	0.43	Neg.	5.46	1.14
13	1.48	8.88	1.48	2.22	Neg.	28.23	5.92
14	1.48	8.88	1.48	2.22	Neg.	28.23	5.92
15	1.48	8.88	1.48	2.22	Neg.	28.26	5.92
16	0.02	0.10	0.02	0.02	Neg.	0.33	0.07
17	0.03	0.18	0.03	0.04	Neg.	0.56	0.12
18	0.01	0.07	0.01	0.02	Neg.	0.23	0.05
19	0.01	0.07	0.01	0.02	Neg.	0.23	0.05
20	1.48	8.88	1.48	2.22	Neg.	28.23	5.92
21	1.48	8.88	1.48	2.22	Neg.	28.23	5.92
22	1.48	8.88	1.48	2.22	Neg.	28.23	5.92
23	1.48	8.88	1.48	2.22	Neg.	28.23	5.92
24	1.48	8.88	1.48	2.22	Neg.	28.23	5.92
25	1.48	8.88	1.48	2.22	Neg.	28.23	5.92
26	1.48	8.88	1.48	2.22	Neg.	28.23	5.92
27	1.50	9.00	1.50	2.26	Neg.	28.77	6.00
28	0.03	0.17	0.03	0.04	Neg.	0.54	0.11
29	1.48	8.88	1.48	2.22	Neg.	28.23	5.92
30	1.48	8.88	1.48	2.22	Neg.	28.23	5.92
31	1.48	8.88	1.48	2.22	Neg.	28.23	5.92
32	1.48	8.88	1.48	2.22	Neg.	28.23	5.92
33	1.48	8.88	1.48	2.22	Neg.	28.23	5.92
34	0.80	4.77	0.80	1.19	Neg.	15.19	3.18
35	1.48	8.88	1.48	2.22	Neg.	28.23	5.92
36	0.03	0.17	0.03	0.04	Neg.	0.54	0.11
37	0.01	0.09	0.01	0.02	Neg.	0.28	0.06
38	0.42	2.50	0.42	0.63	Neg.	7.98	1.67
39	0.01	0.09	0.01	0.02	Neg.	0.54	0.11
40	1.48	8.88	1.48	2.22	Neg.	28.23	5.92
Total	32.65	192.63	32.65	48.97	Neg.	612.10	128.45

Neg.= Negligible

TABLE 8. SUMMARY OF AIR POLLUTANT EMISSIONS FROM FUEL CONSUMPTION IN STATIONARY SOURCES FOR THE STUDY AREA, 1968. (TONS/YEAR)

SOURCE	ALDEHYDES	NO_x	CO	HC	ORGANIC	SO_x	PARTICULATES
Industry							
Coal	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Fuel oil	10	1704	1039	202	15	1107	145
Natural gas	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
TOTAL	10	1704	1039	202	15	1107	145
Residential							
Coal	Neg.	Neg.	Neg.	Neg.	Neg.	1	Neg.
Fuel oil	33	233	33	49	Neg.	461	139
Natural gas	Neg.	3	Neg.	Neg.	Neg.	Neg.	Neg.
TOTAL	33	236	33	49	Neg.	462	139
Commercial-institutional							
Coal	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Fuel oil	13	2214	1351	263	19	1560	176
Natural gas	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
TOTAL	13	2214	1351	263	19	1560	176
Steam-electric							
Coal	2	346	208	40	3	240	27
Fuel oil	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Natural gas	0	0	0	0	0	0	0
TOTAL	2	346	208	40	3	240	27
Total							
Coal	2	346	208	40	3	241	27
Fuel oil	56	4151	2423	514	34	3128	451
Natural gas	Neg.	3	Neg.	Neg.	Neg.	Neg.	Neg.
TOTAL	58	4500	2631	554	37	3369	487

Neg.= Negligible

suggested in the "Rapid Survey Technique"[2].

Vermont is situated in such a way as to be a "bridge State", i.e., considerable traffic passes through the State bound between large metropolitan areas such as Boston to Montreal, New York to Maine, New York to Montreal, etc. Therefore, vehicle mile data would produce more representative figures than gasoline sales to estimate motor vehicular emissions.

The Traffic Division of the Vermont Highway Department has provided a breakdown of vehicle miles into interstate urban, interstate rural, local urban, local rural, etc.

Using this breakdown on a percentage basis, the total vehicle miles were apportioned by grid and the pollutants computed using factors given in "Compilation of Air Pollutant Emission Factors". (See Table 16)

Diesel powered vehicles are divided into two categories--on highway and off highway vehicles. The latter category for the most part, represents farm operations. The emissions were computed separately and the results tabulated in Table 9.

Aircraft

Burlington International Airport is located in grid 26. The information on the number of flights and types of aircraft was obtained through the cooperation of the Airport Manager. The emission rates were computed by applying the appropriate emission factors. (See Table 10)

Ships

The Champlain Transportation Company operates three ferry lines (9 ships) between Vermont and New York. Two of the lines operate out of Chittenden County and the third operates out of Grand Isle County, which is immediately adjacent to Chittenden County. Because of the proximity of the third line the emissions on total fuel were computed and recorded for the Study Area.

TABLE 9. SUMMARY OF AIR POLLUTANT EMISSION FROM MOTOR VEHICLES FOR THE STUDY AREA, 1968. (TONS/YEAR)

	ALDEHYDES	NO_x	CO	HC	ORGANIC ACIDS	SO_x	PARTI-CULATES
On highway diesel vehicles $825x10^3$ gals.	2	92	25	57	13	17	45
Off highway diesel vehicles $121x10^3$ gals.	6	134	36	82	19	24	67
TOTAL	8	226	61	139	32	41	112
Gasoline vehicles $30,575x10^3$ gals.	61	1,728	35,161	3,057	61	137	183
TOTAL	69	1,954	35,322	3,196	93	178	295

TABLE 10. SUMMARY OF AIR POLLUTANT EMISSIONS FROM AIRCRAFT FOR THE STUDY AREA, 1968. (TONS/YEAR)

TYPE OF FLIGHT	FLIGHTS	ALDEHYDES	NO_x	CO	HC	ORGANIC ACIDS	SO_x	PARTI-CULATES
Commercial								
Convential jet	1,959	4	23	34	10	Neg.	Neg.	33
Turboprop	3,359	Neg.	2	3	Neg.	Neg.	Neg.	1
Piston	280	Neg.	1	19	3	Neg.	Neg.	Neg.
Private								
Jet	1,346	3	16	24	1	Neg.	Neg.	23
Piston	21,088	2	66	14	264	Neg.	Neg.	6
Local base	15,987	2	50	1,071	200	Neg.	Neg.	5
TOTAL	44,019	11	158	1,165	478	Neg.	Neg.	68

Neg.= Negligible

It was assumed that half was consumed in Chittenden County and half in New York State. Although Number 2 fuel was used, the factors for diesel fuel were applied because the ferries have diesel engines. (See Table 11)

Solid Waste Disposal

Through questionnaires sent to town officials and commercial establishments an attempt was made to determine the quantity and disposition of refuse from these sources. The returns for the most part were incomplete in number and information.

Using a figure of 5.3 pounds per capita per day, an estimate of the quantity of refuse generated annually was determined[3)].

Using the information from the questionnaires, the annual generated refuse was apportioned in the various categories.

Most towns reported that backyard burning was a common practice (even where landfill and open dump operations were located). Since this burning was presumably small quantities of paper, which was burned weekly, an arbitrary figure of one-half pound per capita per day was assigned to cover this source of air pollution. (See Tables 12, 13, 14)

Solvent Evaporation

Emissions from the handling and use of solvents were obtained for many of the commercial-industrial operations in Chittenden County. Table 15 shows the breakdown of emissions from gasoline evaporation and dry cleaning evaporation. Most solvent evaporation takes place in Greater Burlington.

Industrial Process Losses

There are no measurable industrial process losses in Chitten County due to a lack of heavy or chemical process industries.

Emissions by Grid

For the purposes of modeling the air pollutant emissions in the Study Area, the resulting emissions were apportioned on the grid coordinate system shown in Figure 3.

TABLE 11. SUMMARY OF AIR POLLUTANT EMISSION FROM SHIPS FOR THE STUDY AREA, 1968. (TONS/YEAR)

QUANTITY	ALDEHYDES	NO_x	CO	HC	ORGANIC ACIDS	SO_x	PARTICULATES
$150x10^3$ gals.	1	17	5	10	2	3	8

TABLE 12. SUMMARY OF SOLID WASTE DISPOSAL PRACTICES FOR THE STUDY AREA, 1968. (TONS/YEAR)

TOWNSHIPS	POPULATION	GRID NO.	TOTAL REFUSE	LANDFILL	OPEN DUMP	BACKYARD
Bolton	290	7	280	268	0	12
Burlington	39,630	23	38,322	36,509	0	1,813
Charlotte	1,530	38	1,480	1,340	0	140
Colchester	5,620	14	5,435	4,920	0	515
Essex	9,575	28	9,201	8,330	0	871
Hinesburg	1,605	9	1,552	0	1,405	147
Huntington	630	7	609	0	552	57
Jericho	1,580	5	1,528	1,383	0	145
Milton	3,705	1	3,583	0	3,244	339
Richmond	1,830	12	1,770	0	1,602	168
St.George	295	12	280	268	0	12
Shelburne	3,285	11	3,167	0	2,866	301
So.Burlington	9,120	28	8,819	7,985	0	834
Underhill	1,090	18	1,054	0	954	100
Westford	815	3	788	0	713	75
Williston	2,415	34	2,819	2,552	0	267
Winooski	8,665	24	8,379	7,586	0	793
TOTALS	92,120		89,065	71,141	11,336	6,588

TABLE 13. SUMMARY OF AIR POLLUTANTS FOR THE STUDY AREA FROM BACKYARD BURNING, 1968. (TONS/YEAR)

GRID NO.	ALDEHYDES	NO_x	CO	HC	ORGANIC ACIDS	SO_x	PARTICULATES
1	Neg.	1.8	17.0	1.0	3.0	Neg.	3.2
3	Neg.	0.4	2.6	0.3	0.6	Neg.	0.6
5	Neg.	0.8	6.1	0.4	1.1	Neg.	1.2
7	Neg.	0.4	3.0	0.2	0.5	Neg.	0.6
9	Neg.	0.8	6.1	0.4	1.1	Neg.	1.2
11	Neg.	1.7	12.4	0.8	2.3	Neg.	2.4
12	Neg.	1.0	16.6	0.4	1.2	Neg.	1.4
14	Neg.	2.8	21.9	1.3	3.9	Neg.	4.1
18	Neg.	0.6	4.2	0.3	0.8	Neg.	0.8
23	Neg.	10.0	77.1	4.5	13.6	Neg.	14.5
24	Neg.	4.4	33.7	2.0	5.9	Neg.	6.3
28	Neg.	9.0	72.5	4.3	12.8	Neg.	13.7
34	Neg.	1.5	11.3	0.7	2.0	Neg.	2.1
38	Neg.	1.0	6.0	0.4	1.0	Neg.	1.1
TOTAL	Neg.	36.2	290.5	17.0	49.8	Neg.	53.2

Neg.= Negligible

TABLE 14. SUMMARY OF AIR POLLUTANTS FROM OPEN DUMP BURNING FOR THE STUDY AREA, 1968. (TONS/YEAR)

GRID NO.	ALDEHYDES	NO_x	CO	HC	ORGANIC ACIDS	SO_x	PARTICULATES
1	Neg.	17.8	137.9	8.0	24.3	Neg.	26.0
3	Neg.	3.9	30.3	1.8	5.4	Neg.	5.7
7	Neg.	3.0	23.4	1.4	4.1	Neg.	4.4
9	Neg.	7.7	59.7	3.5	10.5	Neg.	11.3
11	Neg.	15.8	121.8	7.2	21.5	Neg.	22.9
12	Neg.	8.8	68.1	4.0	12.0	Neg.	12.8
18	Neg.	5.3	40.6	2.4	7.2	Neg.	7.6
TOTAL	Neg.	62.3	481.8	28.3	85.0	Neg.	90.7

Neg.= Negligible

TABLE 15. SUMMARY OF AIR POLLUTANTS FROM SOLVENT EVAPORATION FOR THE STUDY AREA, 1968. (TONS/YEAR)

SOURCE	HYDROCARBONS
Dry cleaning	180
Gasoline:	
Bulk storage	
Cone roofs	2,806
Floating roofs	305
Service station tanks	144
Delivering tankers	177
Automobile tanks	99
TOTAL	3,711

TABLE 16. SUMMARY OF AIR POLLUTANT EMISSIONS FROM TRANSPORTATION BY GRID FOR THE STUDY AREA, 1968. (TONS/YEAR)

GRID NO.	ALDEHYDES	NO_x	CO	HC	ORGANIC ACIDS	SO_x	PARTICULATE
1	6	181	3192	433	Neg.	15	24
2	4	122	2147	291	Neg.	10	16
3	1	23	181	23	Neg.	5	6
4	2	54	949	68	Neg.	7	8
5	5	147	2656	261	Neg.	15	21
6	7	26	385	26	Neg.	5	5
7	5	136	2553	193	Neg.	13	19
8	Neg.	9	45	8	Neg.	2	2
9	Neg.	7	39	6	Neg.	2	2
10	5	128	2335	180	Neg.	10	16
11	7	185	3377	260	Neg.	15	23
12	1	143	778	54	Neg.	6	8
13	2	51	966	74	Neg.	4	5
14	2	51	966	74	Neg.	4	5
15	2	62	1232	102	Neg.	6	8
16	Neg.	32	570	33	Neg.	3	4
17	1	44	924	60	Neg.	4	5
18	2	60	1160	77	Neg.	5	7
19	Neg.	10	182	14	Neg.	10	1
20	1	25	482	36	Neg.	2	3
21	1	25	482	36	Neg.	2	3
22	1	25	482	36	Neg.	2	3
23	1	25	482	36	Neg.	2	3
24	Neg.	15	289	22	Neg.	1	2
25	1	25	482	36	Neg.	2	2
26	1	25	482	36	Neg.	2	2
27	1	25	482	36	Neg.	2	2
28	2	65	1330	91	Neg.	6	9
29	1	18	338	26	Neg.	1	2
30	1	25	482	36	Neg.	2	2
31	Neg.	6	108	8	Neg.	Neg.	1
32	Neg.	12	217	17	Neg.	1	1
33	2	75	1136	107	Neg.	6	8
34	2	69	603	108	Neg.	6	9
35	Neg.	12	233	18	Neg.	1	1
36	1	22	900	31	Neg.	2	3
37	1	28	517	40	Neg.	2	4
38	1	38	692	53	Neg.	3	5
39	1	14	258	20	Neg.	1	2
40	1	23	434	33	Neg.	2	2
TOTAL	72	1968	35048	3039	Neg.	189	254

Neg.= Negligible

An immediate need for apportionment by grid is for the purpose of designating air quality control regions.

The emissions of each pollutant were divided into two source subgroups- point and area sources. The point sources were located by horizontal and vertical grid coordinates. (See Table 17)

The emissions for the summation of total air pollutants are presented by grid and jurisdiction in Tables 18 and 19, respectively.

Figures 4 through 10 illustrate pollution density by grid and Figures 11 through 17 show pollution by township. Note that densities are greatest in Burlington and the towns immediately surrounding.

TABLE 17. SUMMARY OF AIR POLLUTANTS FROM POINT SOURCES BY JURISDICTION AND BY GRID FOR THE STUDY AREA, 1968. (TONS/YEAR)

JURISDICTION	GRID NO.	HORIZONTAL COORDINATE	VERTICAL COORDINATE	ALDEHYDES	NO_x	CO	HC	ORGANIC ACIDS	SO_x	PARTICULATES
Bolton	6	67250	492250	Neg.	1	Neg.	Neg.	Neg.	Neg.	Neg.
	7	66800	491500	Neg.	3	Neg.	Neg.	Neg.	2	1
Burlington	20	64100	492800	Neg.	2	Neg.	Neg.	Neg.	1	Neg.
	20	64000	492800	Neg.	2	Neg.	Neg.	Neg.	1	Neg.
	20	64100	492850	Neg.	1	Neg.	Neg.	Neg.	Neg.	1
	24	64200	492600	1	17	5	10	2	3	8
	24	64650	492600	Neg.	1	Neg.	Neg.	Neg.	8	Neg.
	24	64100	492700	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
	24	64200	492600	Neg.	2	Neg.	Neg.	Neg.	1	Neg.
	24	64200	492500	Neg.	4	Neg.	Neg.	Neg.	21	2
	24	64240	492500	Neg.	1	Neg.	Neg.	Neg.	1	Neg.
	24	64240	492600	Neg.	2	Neg.	Neg.	Neg.	12	1
	24	64240	492700	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
	24	64200	492600	Neg.	6	Neg.	Neg.	Neg.	15	2
	24	64100	492750	Neg.	2	Neg.	Neg.	Neg.	8	Neg.
	24	64250	492600	Neg.	1	Neg.	Neg.	Neg.	6	Neg.
	24	64200	492700	Neg.	308	8	3	Neg.	1460	57
	24	64100	492600	Neg.	1	Neg.	Neg.	Neg.	4	Neg.
	24	64100	492600	1	1	Neg.	Neg.	Neg.	1	Neg.
	24	64100	492550	Neg.	496	Neg.	Neg.	11	3	19
	24	64200	492650	Neg.	1	Neg.	Neg.	Neg.	Neg.	Neg.
	25	64400	492600	Neg.	2	Neg.	Neg.	Neg.	1	Neg.
	25	64400	492600	Neg.	2	Neg.	Neg.	Neg.	1	Neg.
	25	64300	492600	2	40	2	2	Neg.	235	18
	25	64300	492600	Neg.	2	Neg.	Neg.	Neg.	1	Neg.
	25	64300	492600	Neg.	9	Neg.	Neg.	Neg.	24	3
	25	64250	492600	Neg.	2	1	1	Neg.	1	Neg.
	25	64300	492600	3	101	3	3	Neg.	514	30
	25	64350	492600	Neg.	1	Neg.	Neg.	Neg.	1	Neg.
	25	64300	492600	Neg.	1	Neg.	Neg.	Neg.	Neg.	Neg.
	25	64400	492600	Neg.	1	Neg.	Neg.	Neg.	1	1
	25	64300	492600	Neg.	1	Neg.	Neg.	Neg.	5	Neg.
	25	64300	492600	Neg.	1	Neg.	Neg.	Neg.	1	Neg.
	25	64300	492600	Neg.	1	Neg.	Neg.	Neg.	1	Neg.
	25	64250	492600	Neg.	4	Neg.	Neg.	Neg.	23	1
	25	64500	492600	2	496	Neg.	Neg.	12	3	20
	29	64100	493000	Neg.	2	Neg.	Neg.	Neg.	1	Neg.

TABLE 17. (cont'd)

JURISDICTION	GRID NO.	HORIZONTAL COORDINATE	VERTICAL COORDINATE	ALDEHYDES	NO_x	CO	HC	ORGANIC ACIDS	SO_x	PARTICULATES
Burlington	29	64200	492500	Neg.	3	Neg.	Neg.	Neg.	24	1
	29	64200	493000	Neg.	4	Neg.	Neg.	Neg.	2	1
	29	64200	492500	Neg.	1	Neg.	Neg.	Neg.	Neg.	Neg.
	29	64200	492500	Neg.	12	Neg.	Neg.	Neg.	14	3
	40	63530	493100	Neg.	1	Neg.	Neg.	Neg.	6	Neg.
	40	63540	49300	Neg.	4	1	1	Neg.	16	1
	40	63540	493250	2	496	Neg.	Neg.	12	3	19
Shelburne	11	64200	491500	Neg.	2	Neg.	Neg.	Neg.	1	Neg.
	11	64200	491520	Neg.	4	Neg.	Neg.	Neg.	2	1
	11	64200	491520	Neg.	1	Neg.	Neg.	Neg.	Neg.	Neg.
Colchester	14	64750	49330	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
	14	64700	493250	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
	21	64400	492900	Neg.	2	Neg.	Neg.	Neg.	1	Neg.
	21	64300	492800	Neg.	1	4	1	Neg.	8	2
	21	64350	49270	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
	21	64700	492800	Neg.	1	Neg.	Neg.	Neg.	Neg.	Neg.
	21	64300	492800	Neg.	3	Neg.	Neg.	Neg.	18	1
	21	64450	492800	Neg.	2	Neg.	Neg.	Neg.	1	Neg.
Essex	22	64600	492900	Neg.	3	Neg.	Neg.	Neg.	16	1
	22	64500	492800	Neg.	5	Neg.	Neg.	Neg.	4	2
	22	64600	492800	Neg.	6	1	1	Neg.	8	11
	5	66000	493000	1	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
	5	66000	493000	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
	27	64650	492600	Neg.	4	Neg.	Neg.	Neg.	2	9
	27	64650	492600	Neg.	4	Neg.	Neg.	Neg.	2	8
	28	65000	492750	2	Neg.	2	2	Neg.	392	19
	28	65200	492800	Neg.	7	Neg.	Neg.	Neg.	25	3
	28	65000	492750	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
	28	65000	492750	1	67	2	2	Neg.	105	11
Huntington	9	65400	490600	Neg.	4	Neg.	Neg.	Neg.	2	1
Jericho	5	65590	492900	Neg.	1	Neg.	Neg.	Neg.	1	Neg.
Richmond	12	65800	491800	Neg.	1	Neg.	Neg.	Neg.	1	Neg.
So. Burlington	26	64500	492500	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
	26	64600	492500	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
	26	64600	492600	Neg.	1	Neg.	Neg.	Neg.	3	Neg.
	26	64700	492600	11	158	2564	478	Neg.	Neg.	68
	30	64300	492400	Neg.	4	Neg.	Neg.	Neg.	21	2
	30	64300	492250	Neg.	1	Neg.	Neg.	Neg.	8	Neg.
Underhill	17	66300	493200	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
TOTAL				26	2321	2593	504	17	3046	323

TABLE 18. SUMMARY OF TOTAL AIR POLLUTANTS FOR THE STUDY AREA BY GRID, 1968. (TONS/YEAR)

GRID NO.	ALDEHYDES	NO_x	CO	HC	ORGANIC ACIDS	SO_x	PARTICULATES
1	8	208	3351	458	28	38	58
2	4	123	2150	312	Neg.	12	17
3	1	30	217	28	6	13	14
4	2	54	950	69	Neg.	8	8
5	6	152	2659	208	Neg.	27	24
6	7	27	385	26	Neg.	7	6
7	5	146	2580	196	6	26	27
8	1	11	45	11	Neg.	6	3
9	1	24	105	17	12	15	26
10	5	128	2335	180	Neg.	12	16
11	7	209	3541	404	24	18	50
12	1	56	866	66	13	13	24
13	3	60	967	76	Neg.	32	11
14	3	63	989	77	4	32	15
15	3	71	1233	104	Neg.	34	14
16	Neg.	32	570	33	Neg.	3	4
17	1	44	925	60	Neg.	5	6
18	2	63	1205	80	8	16	15
19	Neg.	10	182	14	Neg.	10	1
20	2	45	484	67	Neg.	32	10
21	3	48	488	70	Neg.	57	12
22	3	49	440	49	Neg.	57	22
23	2	44	561	73	13	30	23
24	3	877	339	98	12	1574	106
25	9	705	489	88	12	841	82
26	13	93	3043	846	Neg.	33	80
27	3	43	486	1376	Neg.	36	27
28	6	166	1413	173	16	233	64
29	2	2084	340	56	2	62	14
30	2	46	484	83	Neg.	59	11
31	2	15	110	40	Neg.	29	7
32	2	21	218	19	Neg.	29	7
33	4	83	1137	109	Neg.	34	14
34	3	75	618	120	2	22	15
35	2	21	235	20	Neg.	30	7
36	1	22	400	1557	Neg.	2	3
37	1	28	517	40	Neg.	2	4
38	2	42	701	60	2	12	8
39	1	14	258	20	Neg.	2	2
40	4	532	435	35	12	55	28
TOTAL	130	6,564	38,451	7,418	172	3,558	885

Neg.= Negligible

TABLE 19. SUMMARY OF TOTAL AIR POLLUTANTS BY JURISDICTION FOR THE STUDY AREA, 1968. (TONS/YEAR)

JURISDICTION	ALDEHYDES	NO_x	CO	HC	ORGANIC ACIDS	SO_x	PARTICULATES
Bolton	6	84	1444	108	2	16	16
Burlington	28	4322	344	637	24	2656	275
Charlotte	9	257	4555	395	8	32	42
Colchester	14	301	4558	532	3	150	65
Essex	13	319	4184	1061	26	253	106
Hinesburg	3	83	1119	114	18	21	40
Jericho	5	123	2227	166	3	21	19
Milton	8	214	3394	463	28	41	61
Richmond	3	91	1566	120	5	17	20
Shelburne	4	122	2097	1758	Neg.	11	26
So. Burlington	17	181	3739	822	Neg.	115	88
St. George	Neg.	6	87	7	1	7	2
Westford	2	46	553	50	5	13	14
Williston	9	229	2428	947	40	149	69
Winooski	1	15	146	21	Neg.	21	4
Underhill	6	84	2480	170	8	25	26
Huntington	2	87	526	47	1	10	12
TOTAL	130	6564	38,451	7418	172	3558	885

Neg.= Negligible

TABLE 20. AREA CONVERSION TABLE

	Km^2	Mi^2
1	80	30.89
2	60	23.17
3	100	38.61
4	80	30.89
5	100	38.61
6	90	34.75
7	100	38.61
8	60	23.17
9	50	19.30
10	70	27.03
11	100	38.61
12	100	38.61
13	12.5	4.83
14	12.5	4.83
15	25	9.65
16	25	9.65
17	25	9.65
18	25	9.65
19	18	6.95
20	6.25	2.41
21	6.25	2.41
22	6.25	2.41
23	6.25	2.41
24	6.25	2.41
25	6.25	2.41
26	6.25	2.41
27	6.25	2.41
28	25	9.65
29	6.25	2.41
30	6.25	2.41
31	6.25	2.41
32	6.25	2.41
33	25	9.65
34	25	9.65
35	6.25	2.41
36	6.25	2.41
37	10	3.86
38	15	5.79
39	15	5.79
40	6.25	2.41
TOTAL	1341.75	518.00

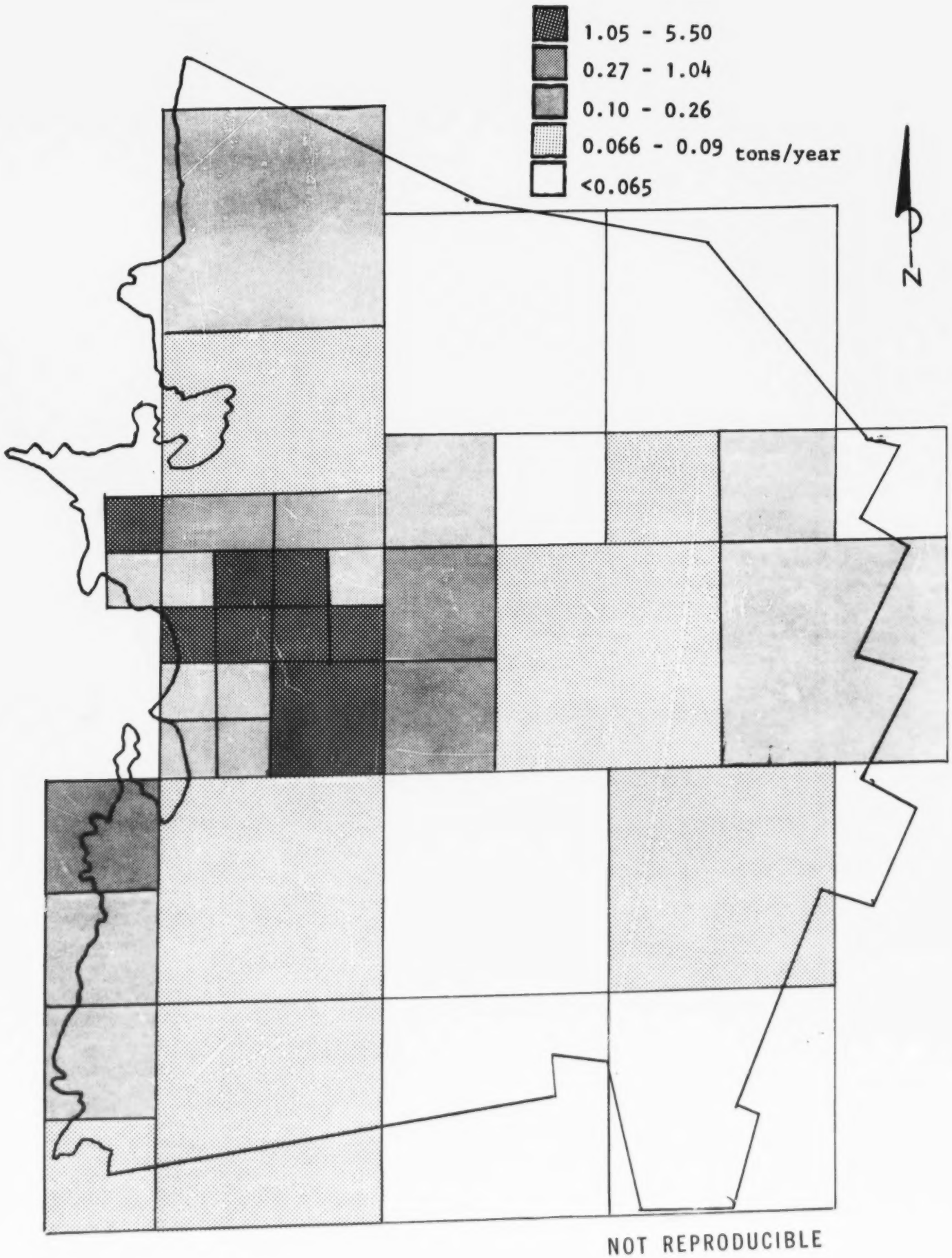


Figure 4. Aldehyde emission density from all sources.

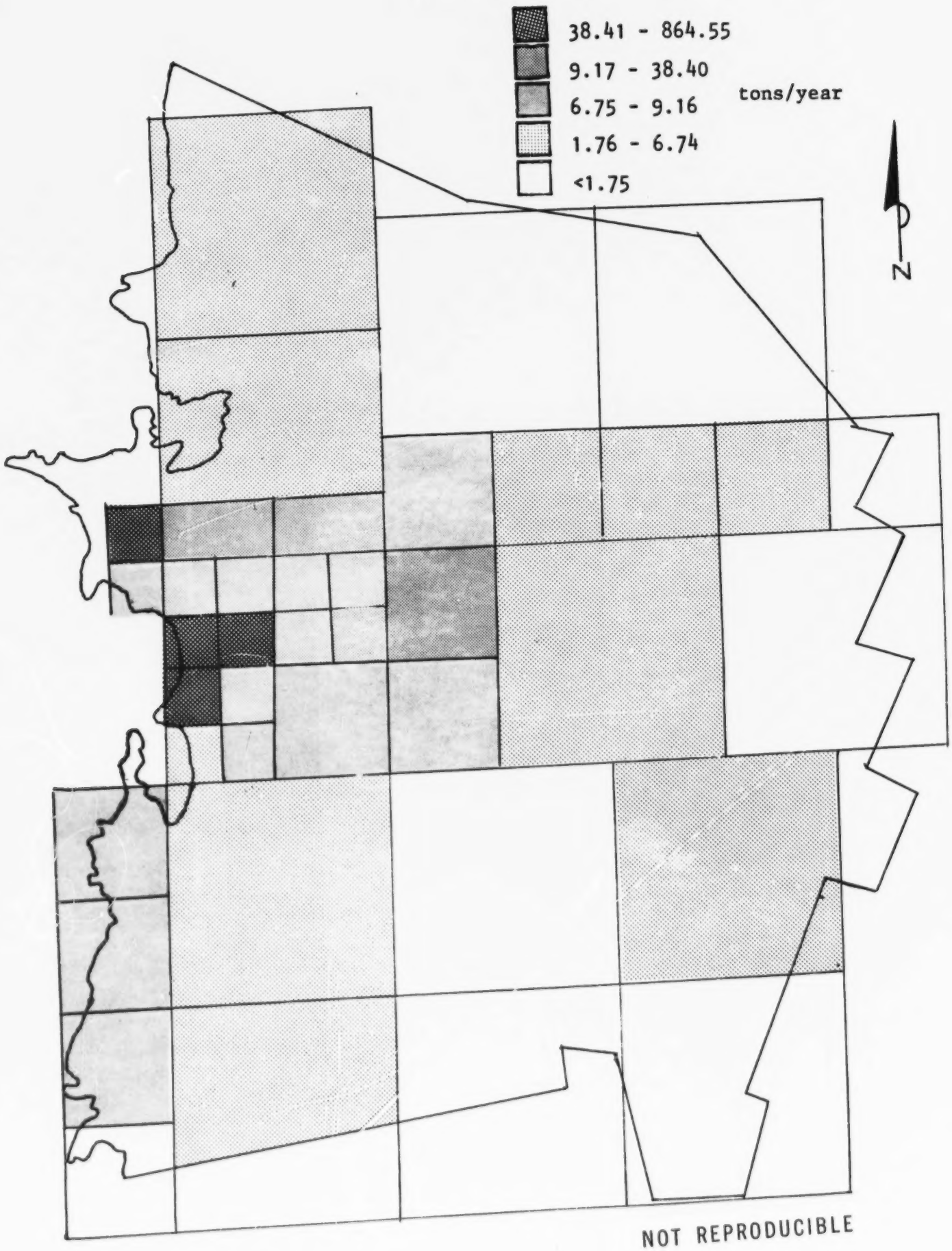
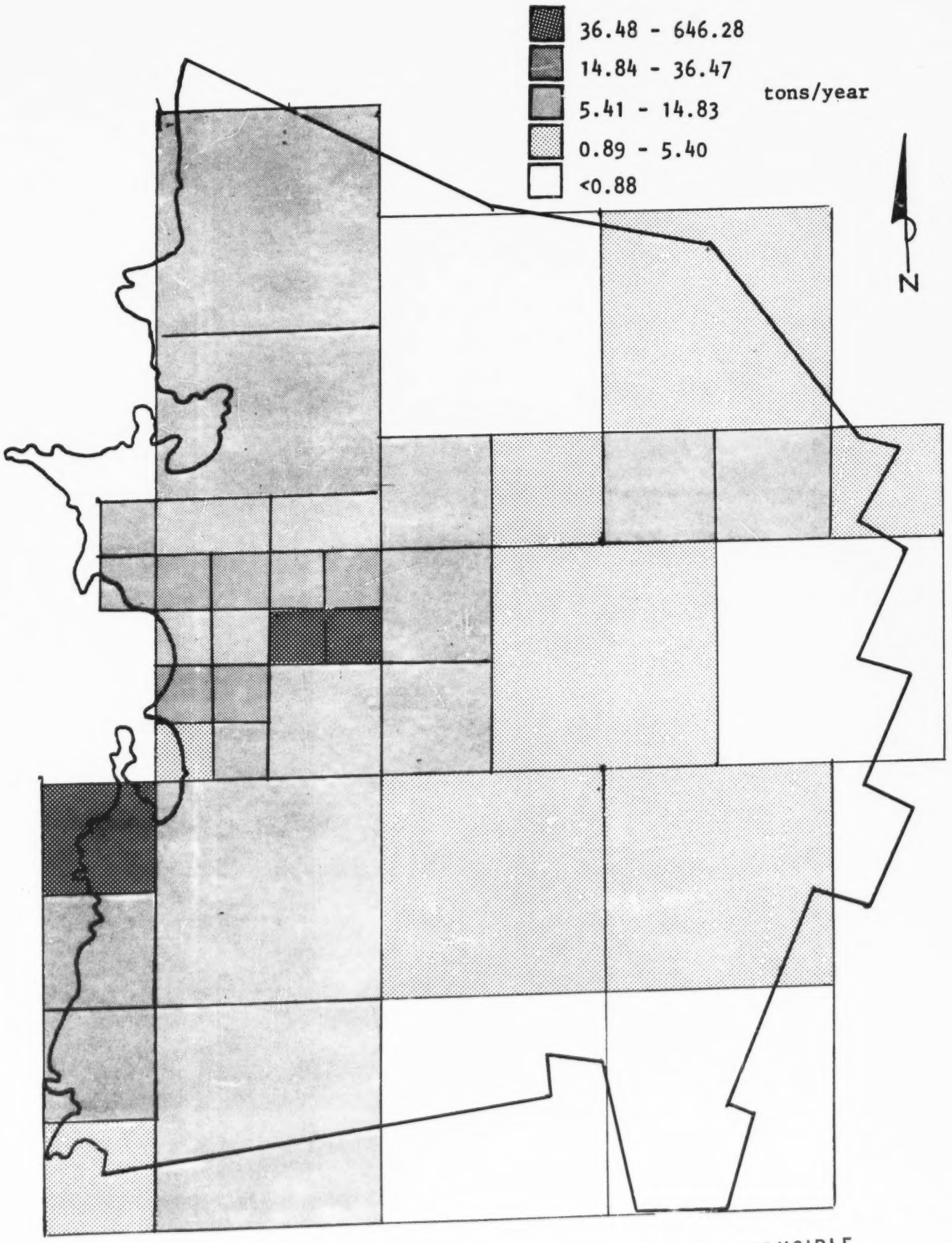


Figure 5. Nitrogen oxide emission density from all sources.



NOT REPRODUCIBLE

Figure 6. Hydrocarbon emission density from all sources.

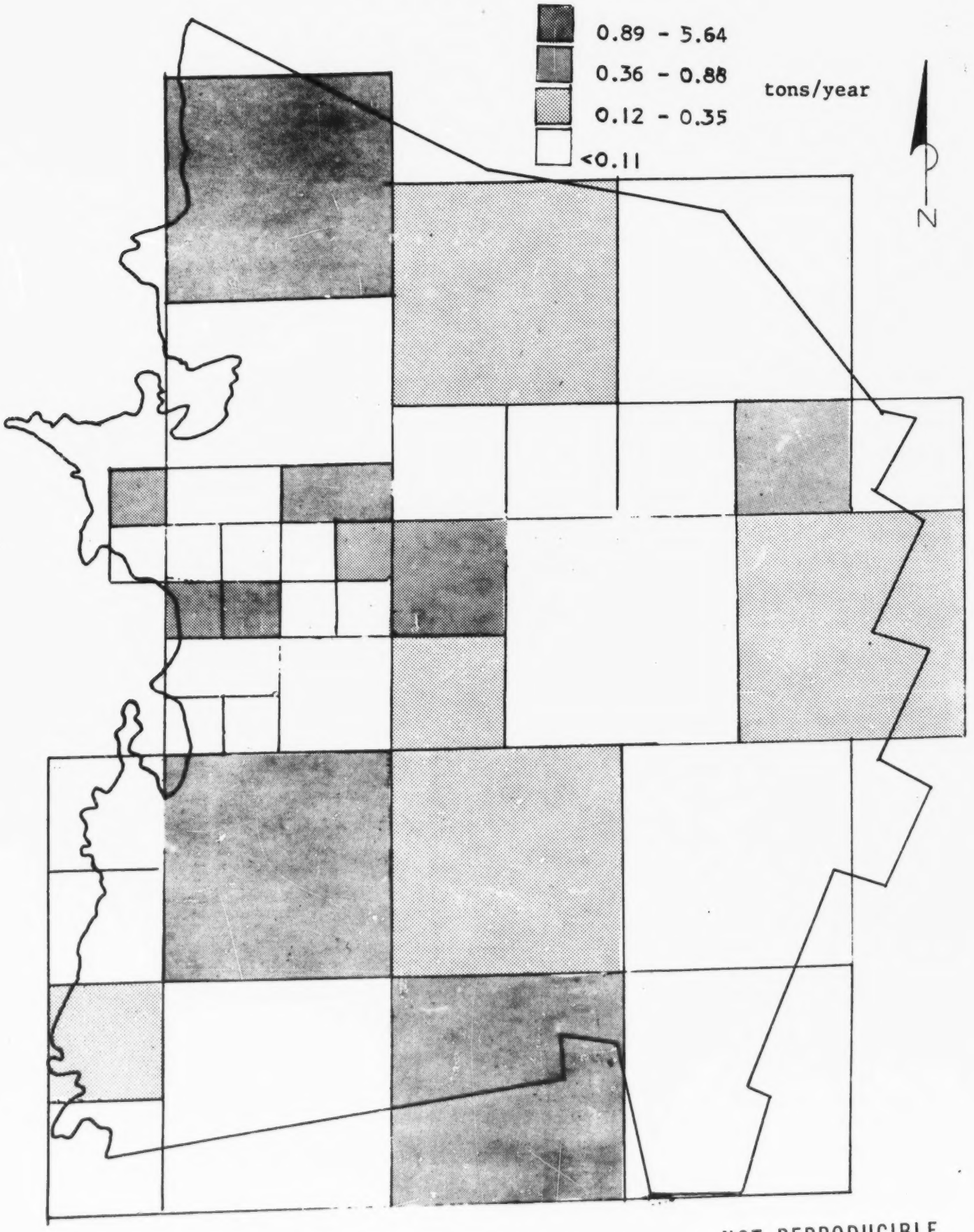


Figure 7. Organic acid emission from all sources.

NOT REPRODUCIBLE

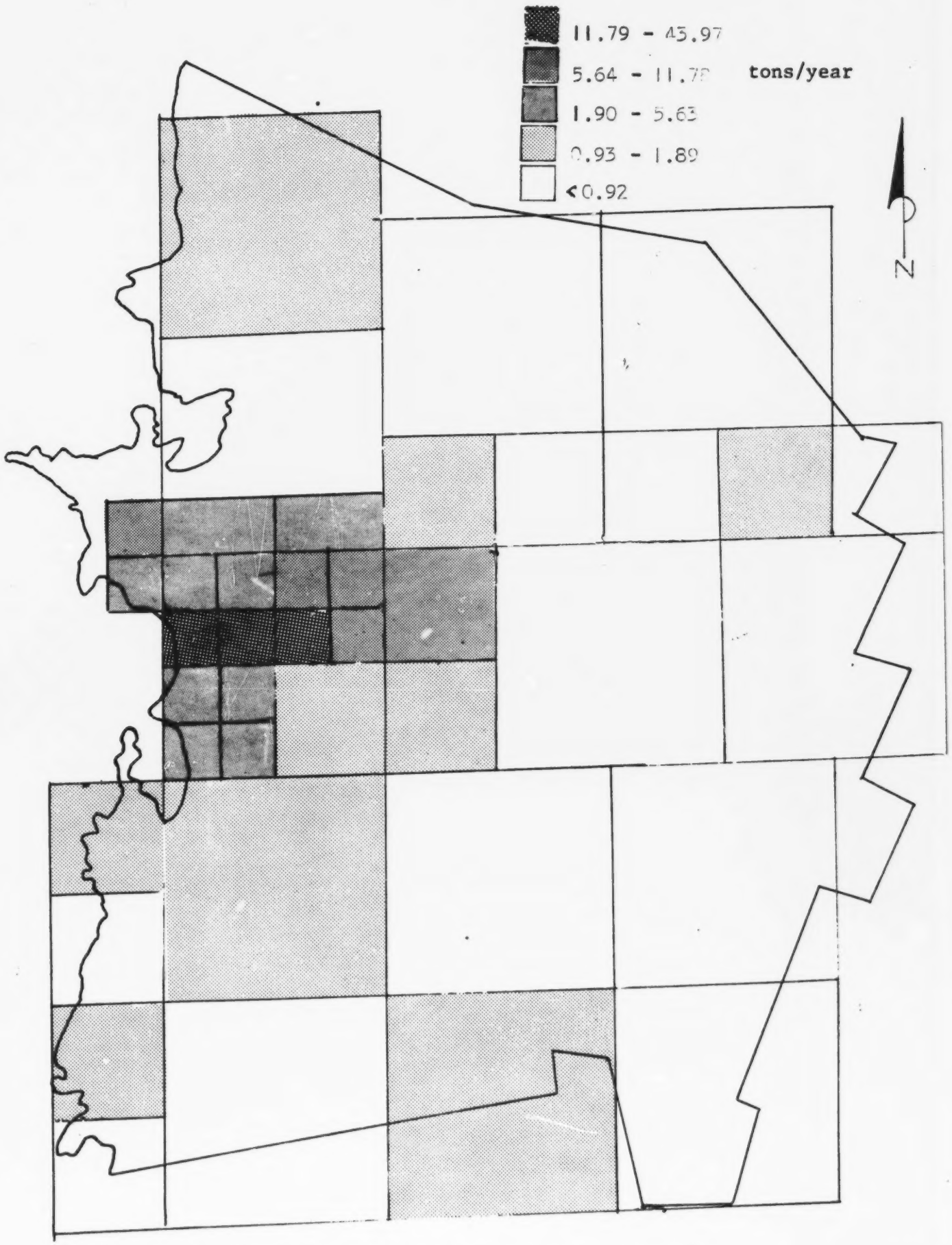


Figure 8. Particulate emission density from all sources.

NOT REPRODUCIBLE

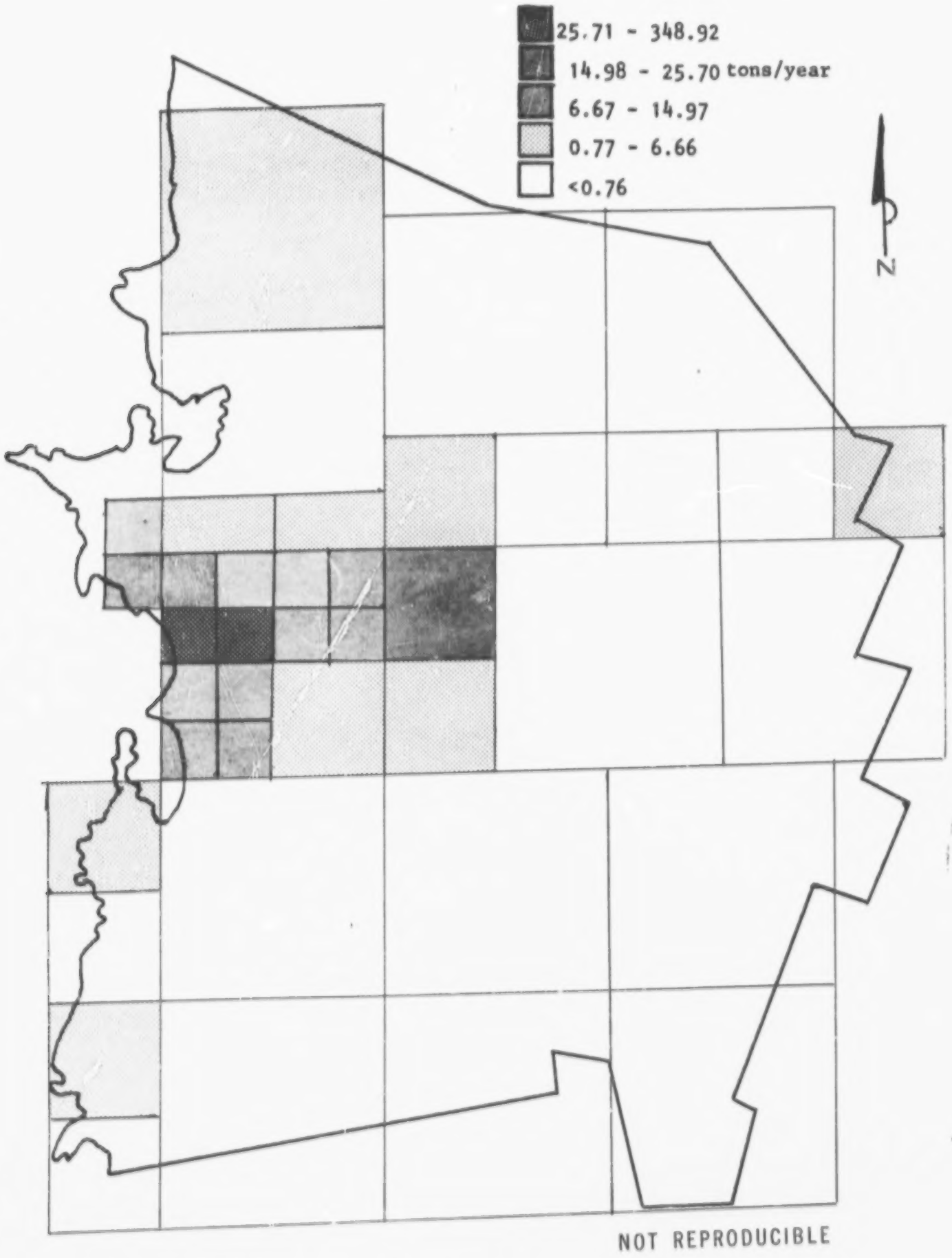


Figure 9. Sulfur oxide emission density from all sources.

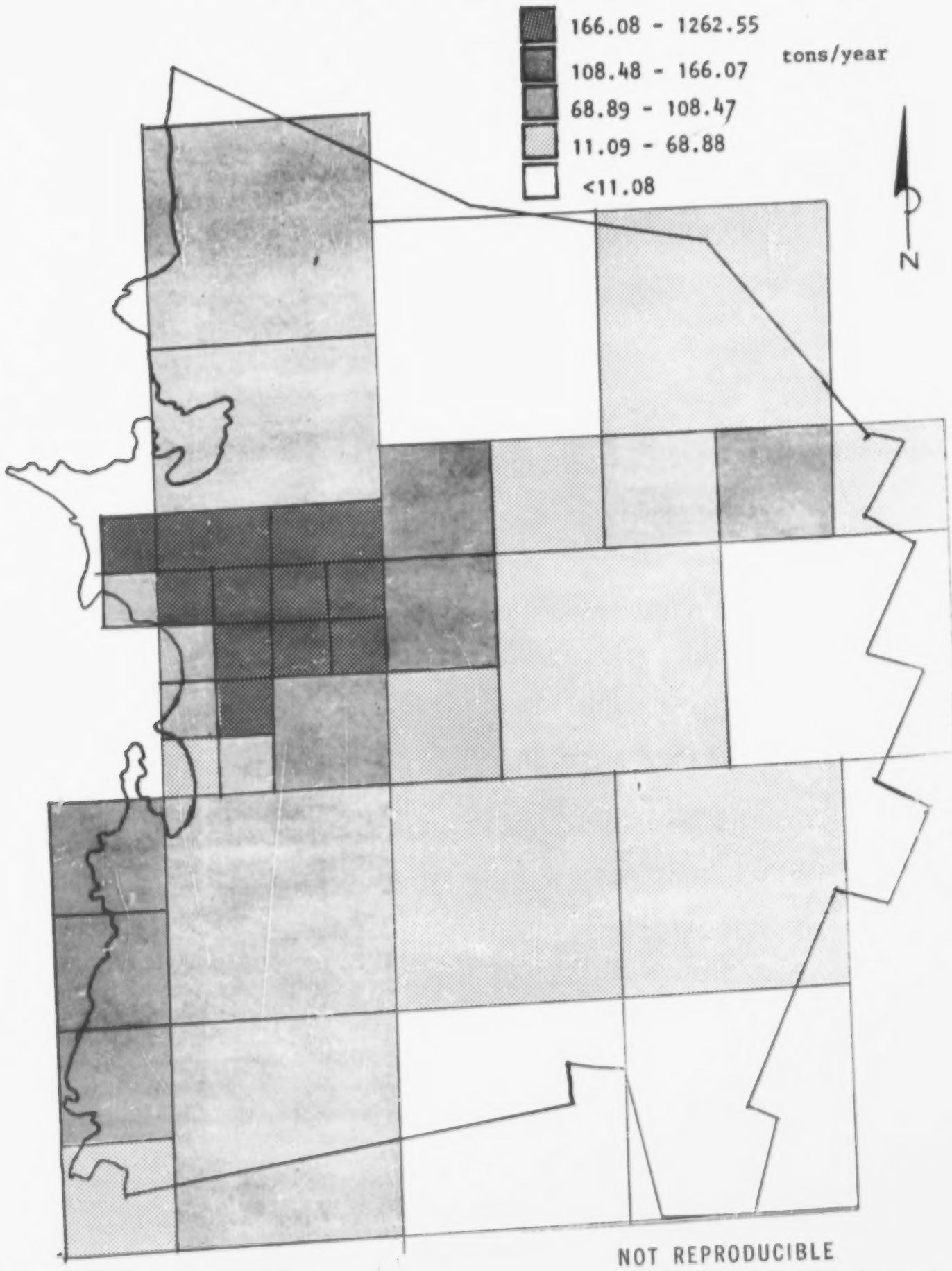


Figure 10. Carbon monoxide emission density from all sources.

Figure II. Aldehyde emission density from all sources.

NOT REPRODUCIBLE

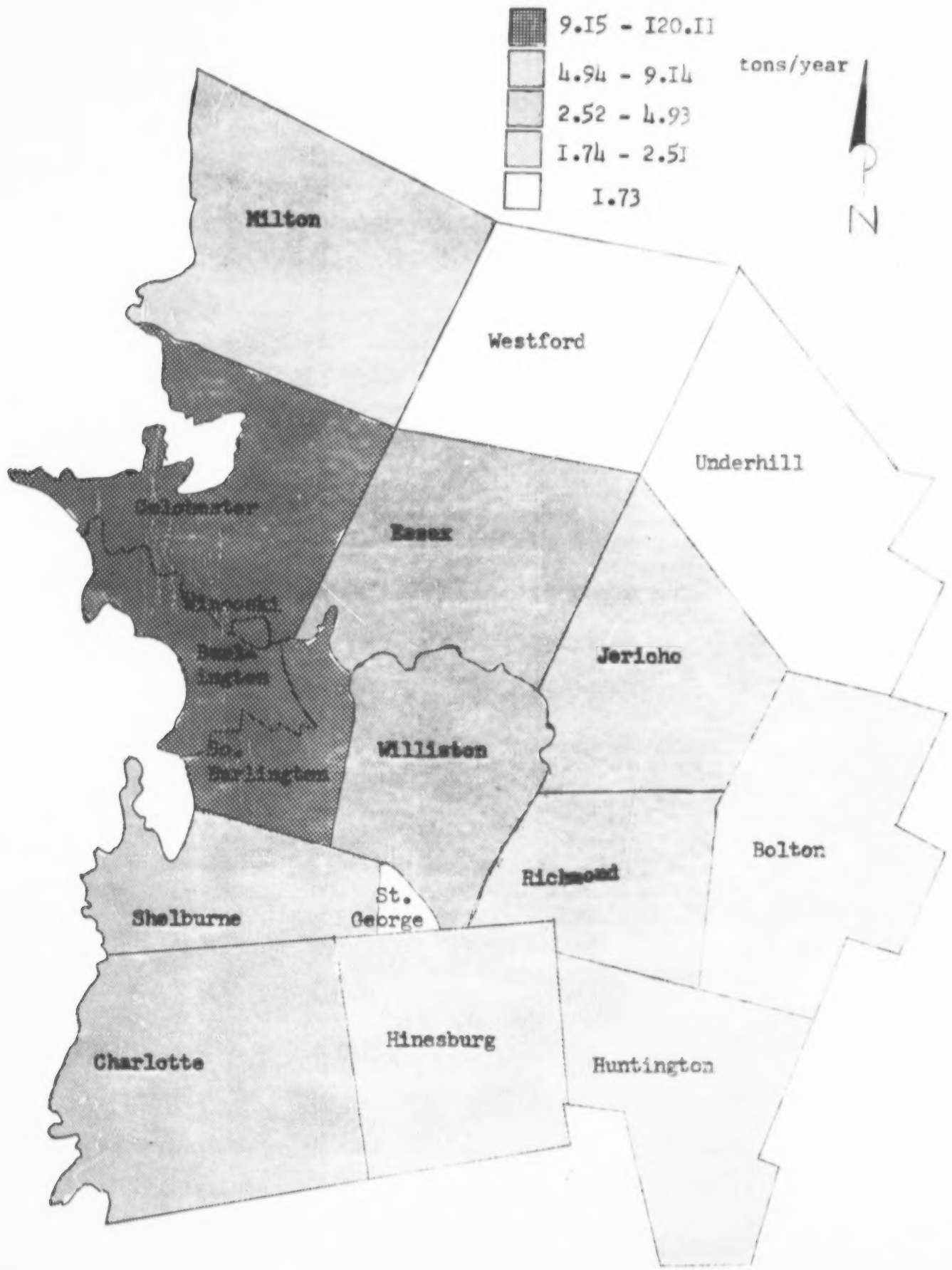


Figure I2. Nitrogen oxide emission density from all sources

NOT REPRODUCIBLE

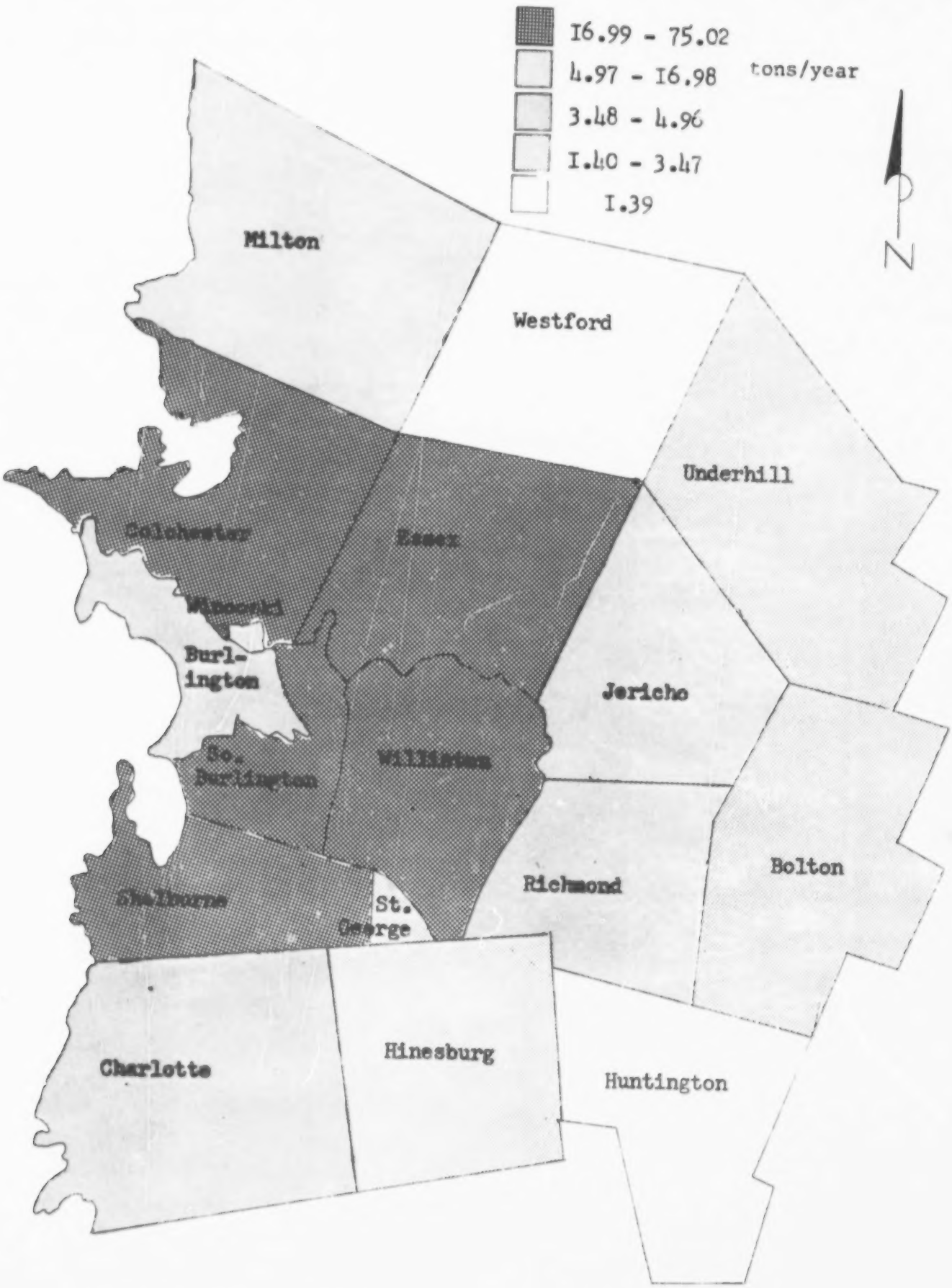


Figure 13. Hydrocarbon emission density from all sources.

NOT REPRODUCIBLE

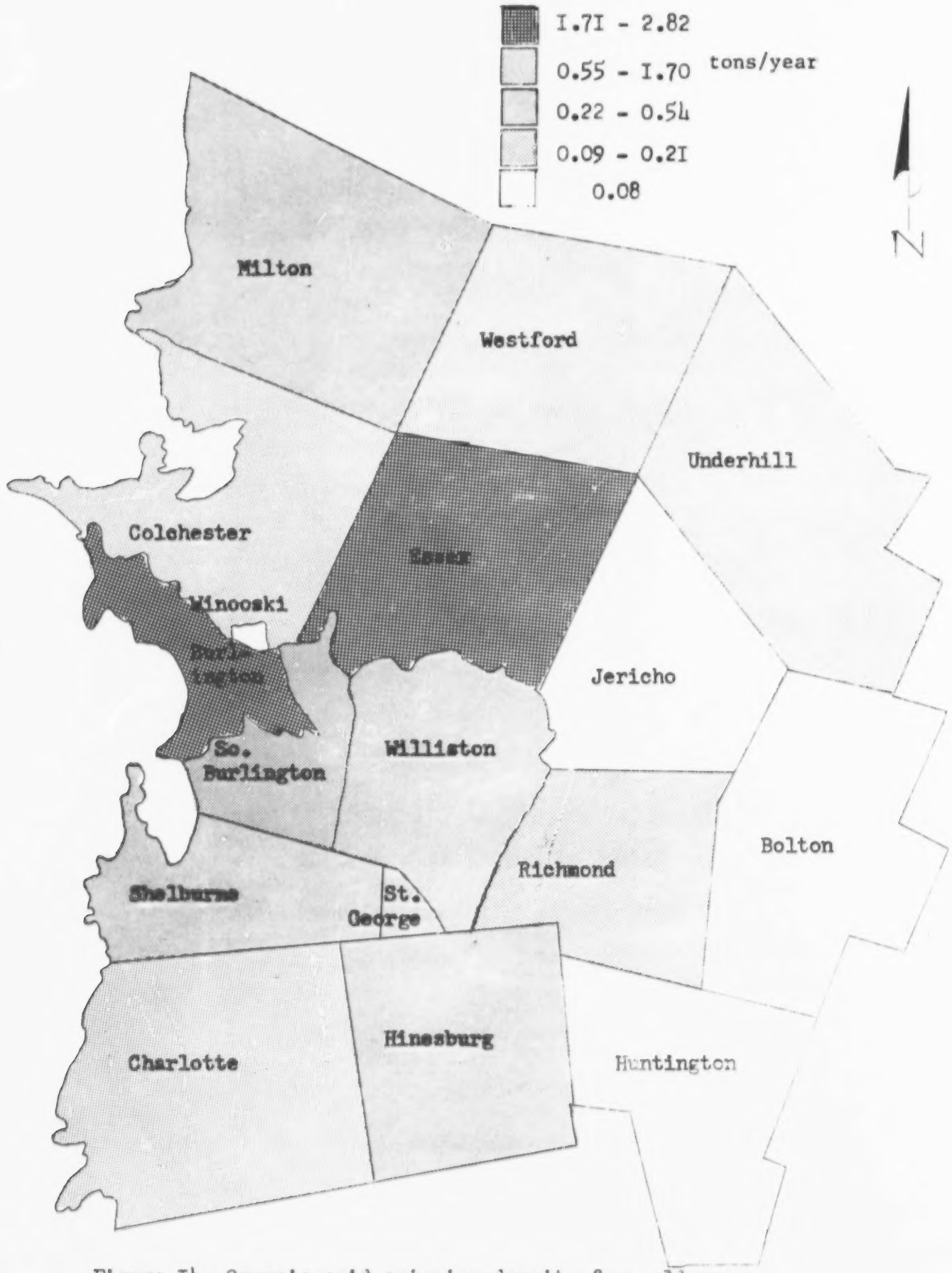


Figure 14. Organic acid emission density from all sources.

NOT REPRODUCIBLE

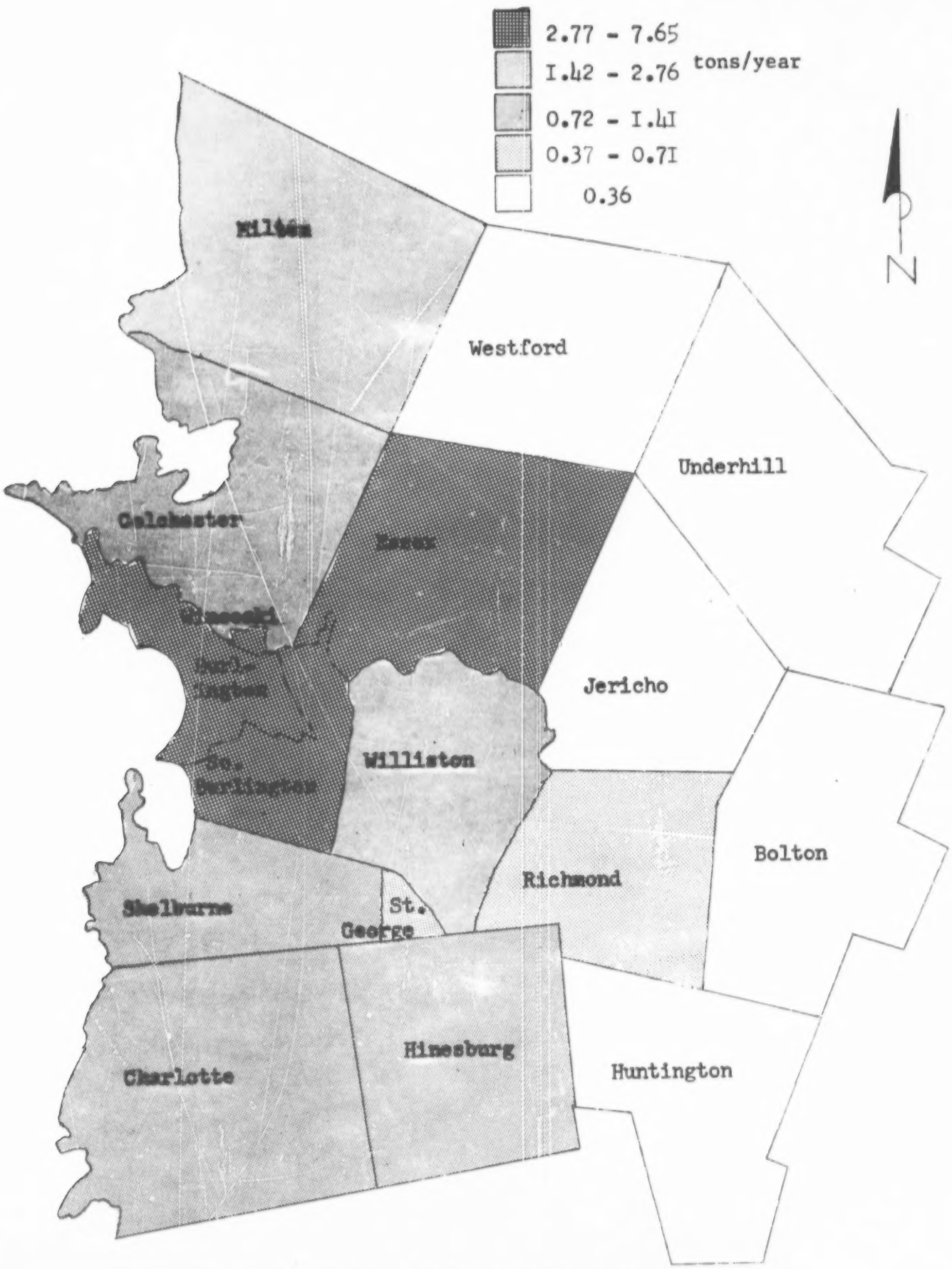


Figure I5. Particulate emission density from all sources.

NOT REPRODUCIBLE

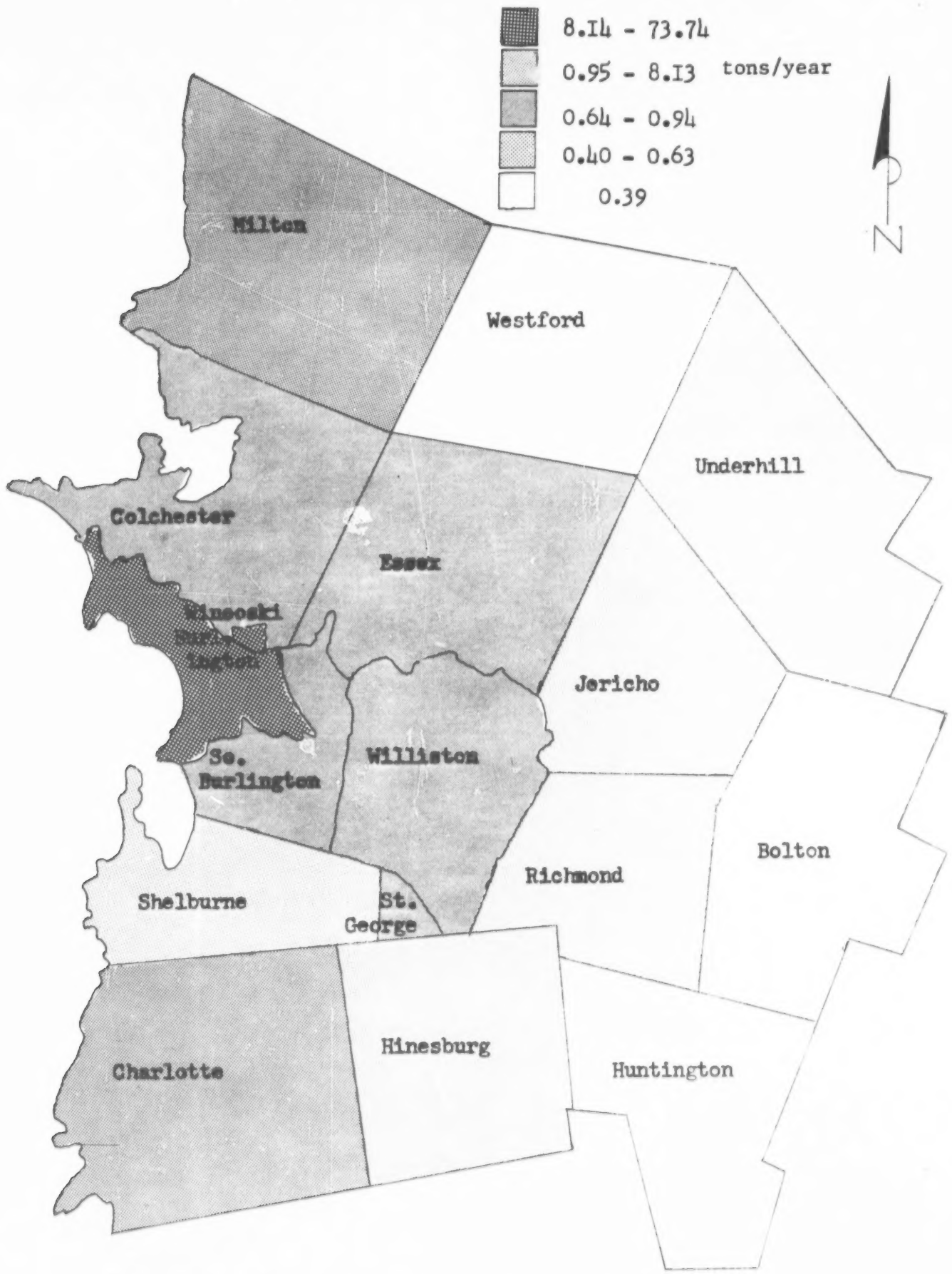


Figure I6 Sulfur oxide emission density from all sources.

NOT REPRODUCIBLE

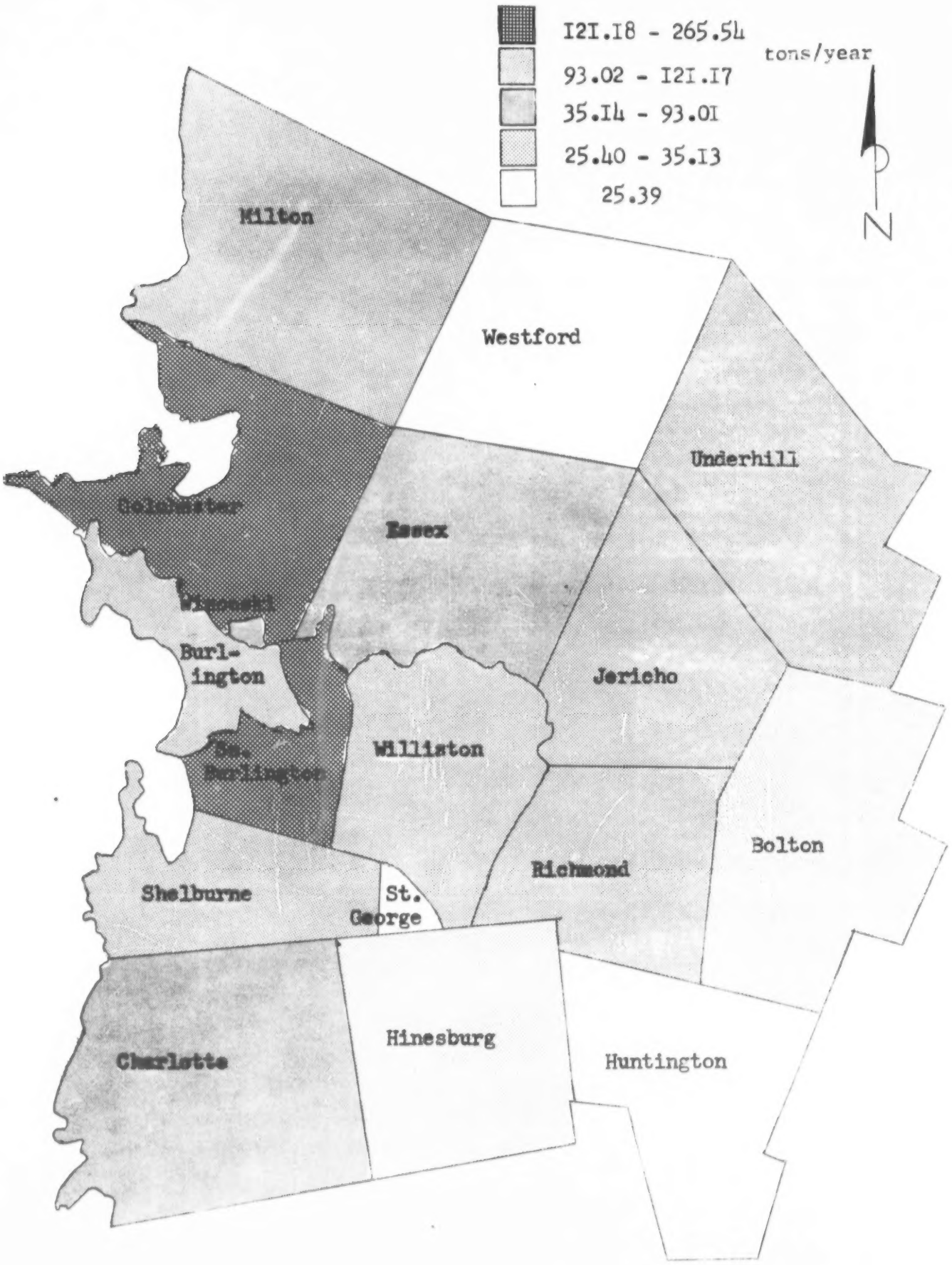


Figure I7 Carbon monoxide emission density from all sources.

NOT REPRODUCIBLE

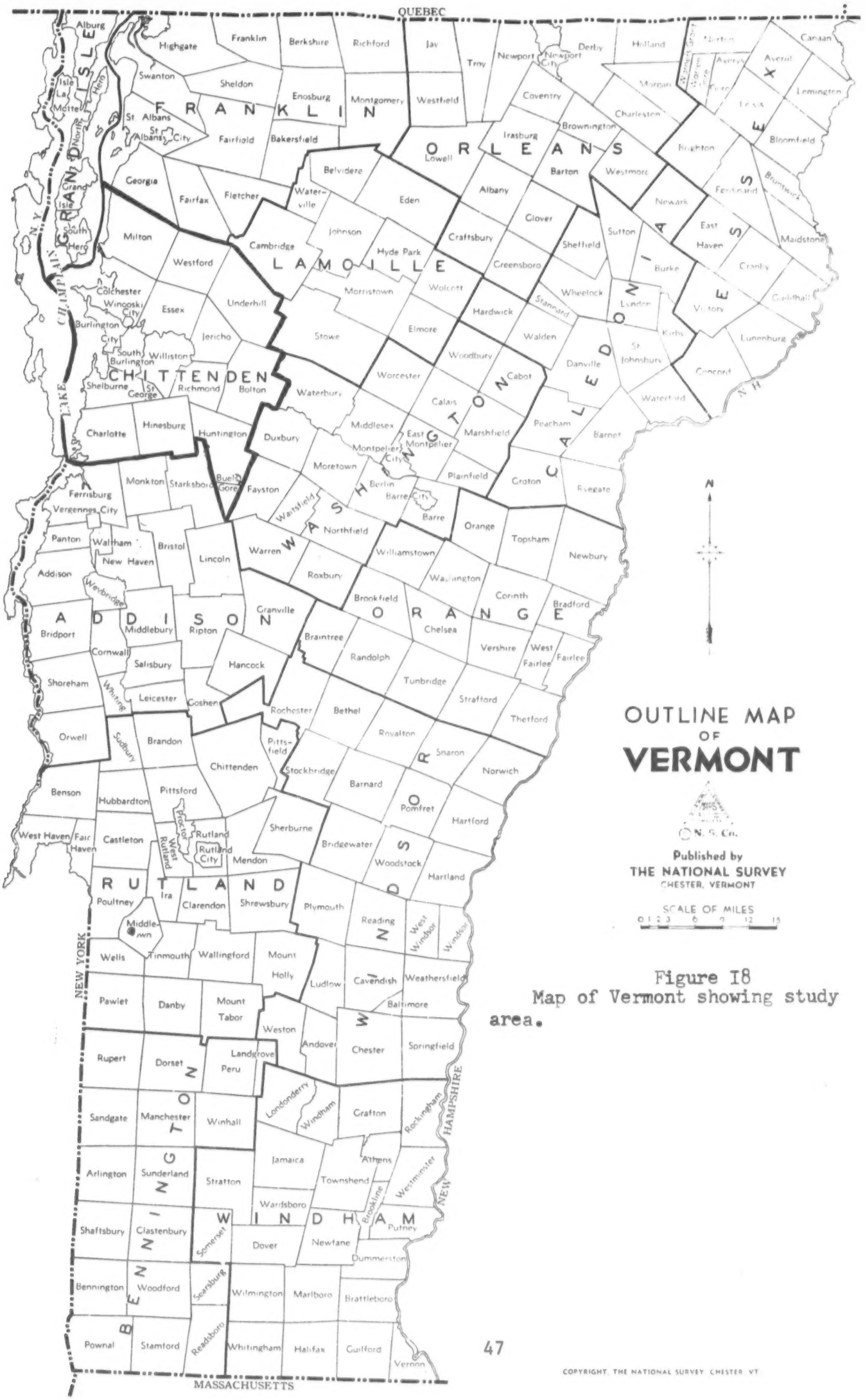


Figure I8
Map of Vermont showing study area.

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REFERENCES

1. Duprey, R. L.; Compilation of Air Pollutant Emission Factors, Department of Health, Education, and Welfare, Public Health Service, April 1968.

2. Ozolins, G. and Smith, R.; Rapid Survey Technique for Estimating Community Air Pollutant Emissions, Department of Health, Education, and Welfare, Public Health Service, October 1966.

3. Personal Communication with N.A.P.C.A., Division of Air Quality Emission Data, Department of Health, Education, and Welfare, Public Health Service, Durham, N.C.